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Freshwater Prawn Culture Using Biofloc Technology

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Introduction

Macrobrachium rosenbergii, commonly known as freshwater prawn/scampi, is being widely cultured in states of India such as Tamil Nadu, Andhra Pradesh, West Bengal and Kerala (Pillai and Panda, 2024). India stands as an important economic resource of aquaculture sector. For the past few years, the export and import of prawns have been increasing which leads to increased source of income for the farmers. Out of various species of freshwater prawn available, *M. rosenbergii* acts as an economically important species. *M. rosenbergii* shows increased growth rate, increased weight gain, better feed conversion efficiency and higher market rate which make it an ideal species for culture (Rayventh et al., 2025). Further, the taste and nutrient composition of the prawn has increased its demand in both domestic and export markets. Although the growth and breeding of freshwater prawn occur in freshwater resources, the incubation and hatching of eggs need seawater/saltwater. So, the larval stages of the prawn were reared in saltwater of salinity 10 – 12ppt and as the larvae reaches the post larval stages, they were reared in freshwater. It is considered an important aquatic organism with a life cycle that involves both freshwater and brackish water environments.

Since, it is an omnivorous species, it can be cultured well in the advanced technology such as biofloc technology and this can make the freshwater prawn as an important species for the future aquacultural sector. The rearing of *M. rosenbergii* in the biofloc technology has improved the growth and survival of the species. The biofloc technology has the ability to convert the waste products such as ammonia and nitrate into flocs thereby improving the water quality. This biofloc technology also increases the protein availability for the species and so

the reduction in feed cost, improved growth and decreased disease occurrence can be achieved.

Designing of ponds and tanks

The biofloc can be developed in the HDPE lined ponds or tanks with central drainage system. The tanks can be built indoor or outdoor. When the tanks are constructed outdoor, a shed has to be built to prevent the tanks from heat and rain. Usually, circular tanks are used for rearing since in circular tanks waste can get accumulated at the centre. A circular frame can be constructed using low-cost iron bars, and a tarpaulin sheet (HDPE) with a thickness of more than 400 microns can be spread over it and converted into a tank. This reduces construction costs and also allows the structure to be relocated as needed.

For the culture of freshwater prawns, tanks of capacity 10000 L – 20000 L can be used. Tank size and capacity are important parameters for culturing any species so as to maintain water quality, prevent wastage of feed and to increase the growth. The optimum DO level for the culture species is 6 ppt. Further, for continuous production of flocs, aerators have to be used. These aerators also help to prevent the settling down of flocs and also to prevent floc spoilage.

Biofloc preparation:

Biofloc can be defined as the aggregates of microbes, algae and organic particles (Raza et al., 2024). These aggregates help to maintain the water quality. For the preparation of bioflocs, a mixture of probiotics is being used. Along with the probiotics, carbon sources such as molasses, sugarcane and tapioca flour are added and left for fermentation. After a few days, microorganisms multiply rapidly in this mixture, leading to the formation of a healthy biofloc. These biofloc can be added to the culture tanks and once the floc volume reaches 20 – 25 ml/l, the PL of prawn can be stocked. In water, excess feed and shrimp wastes undergo chemical transformation by microorganisms, resulting in the formation of harmful substances such as ammonia. These are detoxified, thereby maintaining water quality and keeping the system clean. Moreover, since freshwater prawns directly consume this biofloc, their growth rate increases and feed costs are reduced.

Stocking of *M. rosenbergii*:

The most important aspect in culturing/rearing of freshwater prawn in biofloc is the selection of healthy and good quality seeds. Seeds should be collected from certified hatcheries. PL15 – PL25 or larvae of size 1 – 2 g are considered as ideal. Before stocking, these seeds have to be acclimatized for 15 – 20 minutes and then, temperature and pH should be maintained at ideal level.

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Stocking of 50 – 100 nos/m^2 is considered as ideal and safe density for rearing of freshwater prawns in biofloc system. Stocking more numbers may lead to cannibalism.

Fig. 1 Procurement of *M. rosenbergii* seeds from certified hatcheries

Maintenance practices in shrimp farming:

Continuous aeration (24 h) is very important in biofloc systems. If the dissolved oxygen level decreases, freshwater prawns may suffocate and die. Further, pvc pipes, bamboo tubes should be used as hiding places in the tanks. These hiding places help the prawn to hide themselves at the time of moulting since during moulting the prawns are weak and other prawns may attack them. Therefore, if protective enclosures (or shelters) are provided, mortality will decrease and growth will be better.

Feed management

For the production of healthy and good quality prawns, sinking pellets of 30 – 35% should be provided. The pellets should stay without dissolving for about 2 hours. The feeds should be given at 10% of body weight to the juveniles and then as they grow, it should be reduced to 3% body weight. Due to the presence of biofloc, feed requirements can be reduced by 20–30%. If excess feed is given, water quality deteriorates, biofloc growth is inhibited, and the risk of disease increases (Alkhamis et al., 2023). Carbon addition and feed quantity can be calculated based on the total ammonia nitrogen (TAN) level. This helps in maintaining stable water quality.

Water quality management

The key feature of biofloc technology is the reduced water exchange. In this culture system, water exchange is generally not done, or only minimal water exchange is practiced. Once the water turns brown in color, aeration becomes essential. The parameters like pH, ammonia, nitrite, floc volume should be monitored daily. The carbon sources and aeration should be increased when needed. The following conditions should be maintained: DO - >5 ppm, pH – 7.0 – 8.5, ammonia - <0.5 ppm, temperature – 26 - 32°C.

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Harvesting of *M. rosenbergii*

During the culture period, sampling should be done at fortnight intervals for growth analysis. 40 – 50 g size would be attained in a period of 4 months. The culture duration for *M. rosenbergii* is 120 – 180 days (4 – 6 months) and the survival rate is 70 – 85 %. When cultured in healthy and ideal environmental conditions, the survival rate may reach 90 %. At the time of harvest, the average weight of a prawn ranges from 70–100 grams. For each crop cycle (4–6 months), a production of about 2–4 tons per hectare can be obtained, or 3–6 kg/m³ in a tank system. With efficient management, yields up to 5 tons can be achieved. After 90 days, partial harvesting can be carried out by removing the larger prawns, and complete harvesting can be done within 150–180 days. This technology offers several advantages such as minimal water exchange, lower disease risk, faster growth, and reduced feed cost.

Fig. 2 Prawns harvested from biofloc systems

Advantages of rearing *M. rosenbergii* in biofloc system:

* The continuous supply of rich nutrients from the biofloc helps to improve the growth of the prawns.
* Since it can be cultured at high stocking densities, higher profits can be obtained even from a small area of land. It is especially suitable for indoor culture systems.
* From the results of the researches conducted, it is evident that the weight gain and survival rate increased to 50% and 80%, respectively, when cultured in biofloc systems.
* Increased growth rate and survival rate is achieved.
* The beneficial bacteria from the bioflocs improve the immune system of the prawns being cultured.
* This technology reduces the input cost upto 15 – 20% by increasing the feed conversion ratio and by providing natural foods to the prawns

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